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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/719,591	12/12/2000	Mohammed N. Islam	20434-736	2624

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EXAMINER	
HUGHES, DEANDRA M	
ART UNIT	**PAPER NUMBER**
3663	

DATE MAILED: 02/10/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/719,591	ISLAM ET AL.	
	Examiner	Art Unit	
	Deandra M Hughes	3663	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 November 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-52* is/are pending in the application.

4a) Of the above claim(s) *32-43 and 49* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-31,44-48 and 50-52* is/are rejected.

7)☒ Claim(s) *3 and 4* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *11/12/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 24-26, 31, 50, and 52 are rejected under 35 U.S.C. 102(e) as being anticipated by Hansen (US 5,887,093 filled Sep. 12, 1997).

With regard to claims 24, 31, and 50, Hansen discloses a fiber-optic transmission system, the fiber-optic transmission system comprising:

- at least one transmission link (fig. 2, #22) operable to communicate one or more optical signals in a violet communication band (violet band: 1430-1530nm; col. 3, lines 63-65), the at least one transmission link having:
  - a length (this is inherent);
  - an optical loss (all fibers inherently experience attenuation; col. 2, line 43);
  - a dispersion (this is inherent; otherwise there would be no need for dispersion *compensation*);

- a sign of dispersion (dispersion inherently is either negative or positive; see e.g., col. 2, line 28);
- and a cutoff wavelength (all fiber has a cut off wavelength; see Fiber Optics Standard Dictionary, 3rd edition);

- wherein the at least one transmission link comprises a DSF having at least one fiber non-linearity effect and a zero dispersion wavelength (Since the invention of Hansen is intended to *upgrade* optical fiber systems, see 1st line of abstract, and Hansen discloses that optical transmission systems use DSF, see col. 2, lines 1-23; then the transmission link of the optical system that the module of Hansen is upgrading contains a DSF. Further, 4-photon mixing is a non-linear effect and all DSFs have a zero dispersion wavelength, see col. 2, line 2; 1550nm)

- an optical element operable to receive the one or more optical signals in the violet communication band and to amplify the one or more optical signals (fig. 1), the optical element comprising:
  - an input port (#1) operable to receive the one or more optical signals from the at least one transmission link, the optical signal comprising a signal wavelength (col. 3, lines 63-65);
  - a distributed Raman gain medium coupled to the input port and operable to amplify the one or more optical signals (the 1st spool of DCF; col. 4, lines 1-65), the distributed Raman gain medium

having an optical loss, wherein the optical element operates to compensate for the optical loss of the transmission link and the optical loss of the distributed Raman gain medium;

- a pump source operable (#5) to generate a pump light to pump the distributed Raman gain medium at a pumping level sufficiently high so that the one or more optical signals experience a net gain experienced (col. 4, line 60-65) in the violet communication band (1520nm to 1530nm) is sufficiently far from the zero dispersion wavelength (1550nm) of the at least one transmission link to avoid the at least one fiber non-linearity effect in the at least one transmission link and:
- an output port (#6) for outputting the amplified one or more optical signals.

With regard to claim 25, the fiber is standard dispersion fiber (col. 3, line 46).

With regard to claim 26, four-photon mixing is four-wave mixing.

With regard to claim 52, 1530nm is at least 20nm from 1550nm.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-5, 7-8, 44, 47, 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hansen (US 5,887,093 filled Sep. 12, 1997) in view of Agrawal (Fiber Optic Communication Systems, 1997)

With regard to claims 1-4, Hansen discloses an optical element (fig. 1) operable to compensate for dispersion located with a transmission link (col. 3, lines 20-25) the optical element comprising:

- an input port (#1) operable to receive an optical signal from at least one transmission link (fig. 2, #22), the optical signal comprising:
  - an optical signal wavelength (col. 2, line 55, 1550nm);
  - the at least one transmission link having:
    - a length (this is inherent);
    - an optical loss (all fibers inherently experience attenuation; col. 2, line 43);
    - a dispersion (this is inherent; otherwise there would be no need for dispersion *compensation*);
    - a sign of dispersion (dispersion inherently is either negative or positive; see e.g., col. 2, line 28);
    - and a cutoff wavelength (all fiber has a cut off wavelength; see Fiber Optics Standard Dictionary, 3rd edition);
- a distributed Raman gain medium having an optical loss and connected to the input port (col. 4, lines 54-55; col. 5, line 9; the first spool);

- the distributed Raman gain medium (DCF) operable to amplify the optical signal and to compensate for dispersion associated with the at least one transmission link (col. 5, line 9; col. 4, lines 54-55) wherein the distributed Raman gain medium comprises:
- a pump source (fig. 1; #5) configured to be coupled to the distributed Raman gain medium;
- wherein the distributed Raman gain medium comprises a sign of dispersion that is opposite a sign of dispersion associated with the at least one transmission link (col. 5, lines 10-15);
- the pump source operable to generate a pump signal to pump the distributed Raman gain medium to compensate for the optical loss of the transmission link and the optical loss of the distributed Raman gain medium (col. 4, line 54-60) ;
- wherein the pump source generates the pump signal at a pumping level sufficiently high so that the optical signal experiences a net gain (this is inherent in that the DCF as an amplifier medium compensates for loss - if the fiber did not experience a net gain, then it could not compensate for loss); and
- an output port (fig. 1, #6) for outputting the amplified optical signal.

Hansen does not specifically disclose a dispersion-length product that is substantially equal in magnitude to a dispersion-length product of the at least one transmission link. However, this is the well-known concept of dispersion management, as is taught by

Agrawal. Equation 9.4.2 (pg. 435) of Agrawal teaches that the sum of the dispersion-length products of multiple segments of fiber should be zero in order to achieve dispersion compensation. It would have been obvious to one of ordinary skill in the art (e.g., an optical engineer) to optimize dispersion-length products of fiber segments for the advantage of compensating for the detrimental effect of dispersion in a transmission system.

With regard to claim 5, the transmission system is open-loop (fig. 2).

With regard to claim 7, the DCF module can contain multiple spools of fiber (col. 5, line 9; the pump #5 is counter-propagating).

With regard to claim 8, the isolator is #4.

With regard to claim 44, the pump (#5) is laser diode.

With regard to claim 47, Raman scattering is inherent in Raman amplification.

With regard to claim 51, 'equal to' is within 10%.

5. Claims 12-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hansen (US 5,887,093 filled Sep. 12, 1997) in view of Grubb (WO 98/42088 published Sept. 24, 1998).

With regard to claim 12, Hansen discloses a fiber-optic transmission system comprising:

- an input port (#1) operable to receive an optical signal from at least one transmission link (fig. 2, #22), the optical signal comprising:
  - o one or more optical signal wavelengths (col. 2, line 55, 1550nm);
  - o the at least one transmission link having:

- a length (this is inherent);
- an optical loss (all fibers inherently experience attenuation; col. 2, line 43);
- a dispersion (this is inherent; otherwise there would be no need for dispersion *compensation*);
- a sign of dispersion (dispersion inherently is either negative or positive; see e.g., col. 2, line 28);
- and a cutoff wavelength (all fiber has a cut off wavelength; see Fiber Optics Standard Dictionary, 3rd edition);

- a Raman gain fiber (DCF is the Raman gain fiber; col. 4, lines 54-67) coupled to the signal input port (fig. 1, #2) and operable to amplify the optical signal, the Raman gain fiber having an optical loss and comprising a first Raman gain segment and a second Raman gain segment (col. 6, lines 40-45; one or more spools of fiber), wherein the optical signal traverses the Raman gain fiber in a first direction (left to right);
- a pump source (fig. 1, #5) configured to be coupled to the Raman gain fiber;
- the pump source operable to generate a pump signal to pump the Raman gain fiber to compensate for the optical loss of the transmission link and the optical loss of the Raman gain fiber (col. 4, lines 55-65), the pump signal comprising:

- a pump wavelength and a pump power wherein (this is inherent);
- the pump source produces the pump signal at a pumping level sufficiently high so that the optical signal experiences a net gain (this is inherent; further it is disclosed; col. 4, lines 60-65);
- a signal output port for outputting the optical signal (fig. 1, #6); and

Hansen does not specifically disclose a pump shunt. However, Grubb teaches a pump shunt (#28) operable to couple at least a portion of the pump signal between a 1st amplifier (#14) and the 2nd amplifier (#22), wherein the 1st Raman gain segment is coupled to the input signal port (S_{in}) and; the 2nd Raman gain segment is coupled to the signal output port (S_{out}) and wherein the pump signal traverses the 1st Raman gain segment in a direction counter (the pump is counter-propagating to the 1st amplifier) to the 1st direction and then traverses the 2nd segment to deplete pump power of the pump signal (this is inherent; pump power is depleted in order for amplification to occur). It would have been obvious to one of ordinary skill in the art (e.g., an optical engineer) to apply the pump shunt of Grubb to the invention of Hansen for the advantage of pump power reuse.

With regard to claim 13, the isolator is #4.

6. Claims 9-11, 14-16, 21-23, and 27-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hansen (US 5,887,093 filled Sep. 12, 1997) in view of Agrawal

(Fiber Optic Communication Systems, 1997) and further in view of Huber (US 6,661,973 filed Jun. 4, 1999).

Hansen in view of Agrawal does not specifically disclose an optical equalizer or an add/drop multiplexer. However, these are well known elements in optical transmission systems, as is taught by Huber (#24). It would have been obvious to one of ordinary skill in the art (e.g., an optical engineer) to use an add/drop multiplexer and/or an optical equalizer for the advantage, respectively, of changing the transmission channels and equalizing the gain.

7. Claim 45 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hansen (US 5,887,093 filled Sep. 12, 1997) in view of Agrawal (Fiber Optic Communication Systems, 1997) and as applied to claim 1 above, and further in view of Grubb (US 5,323,404 filed Nov. 2, 1993).

Hansen in view of Agrawal does not specifically disclose a Raman Oscillator as a pump source. However, this is a well-known pump source, as is taught by Grubb (fig. 5, #56). It would have been obvious to one of ordinary skill in the art (e.g., an optical engineer) to use a Raman oscillator as a pump source for the advantage of pump wavelength tuning.

8. Claim 6, 16-20, 46, and 48 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hansen (US 5,887,093 filled Sep. 12, 1997) in view of Agrawal (Fiber Optic Communication Systems, 1997) and as applied to claim 1 above, and further in view of Hansen (US 6,304,368 filed Jan. 15, 1999; hereafter HANSEN-2).

With regard to claim 46, Hansen in view of Agrawal does not specifically disclose a wavelength shifter as a pump source. However, this is a well-known pump source, as is taught by HANSEN-2 (col. 3, line 61). It would have been obvious to one of ordinary skill in the art (e.g., an optical engineer) to use a wavelength shifter as a pump source for the advantage of pump wavelength tuning.

With regard to claims 6, 17-20 and 48, Hansen in view of Agrawal does not specifically disclose that the optical signal is amplified in a closed-loop fashion. However, HANSEN-2 teaches amplification in a closed-loop fashion. It would have been obvious to one of ordinary skill in the art (e.g., an optical engineer) to amplify the optical signal in a closed-loop fashion for the advantage of an independent optical path for each wavelength band.

Claim Objections

9. Claims 3-4 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. With regard to claim 4, within 10% is broader than 'equal to'.

Information Disclosure Statement

10. The information disclosure statement (IDS) filed on Nov. 12, 2004 has been considered.

Response to Arguments

11. Applicant's arguments with respect to claims 1-31 and 44-48 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

12. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Deandra M Hughes whose telephone number is 703-306-4175. The examiner can normally be reached on M-F, 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thomas H Tarcza can be reached on 703-306-4171. The fax phone

number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Deandra M Hughes
Examiner
Art Unit 3663

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